The Maryland Fruit Grower

October, 1935

Maryland State
Horticultural Society

CIDER MAKING

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Farmers' Bulletin 1264, "Farm Manufacture of Unfermented Apple Juice" classifies apples in groups according to their cider making qualities:

Group 1—*Sweet sub-acid group*—Baldwin, Hubbardston, McIntosh, Fameuse, Northwestern, Rome and Stark. Juice sweet and of good flavor, but lacks tartness and acidity.

Group 2—*Mildly acid to slightly tart*—Winesap, Jonathan, Yellow Newtown, Stayman, Northern Spy, Wealthy and York. Any of these are good for a single-variety cider or good for blending with the sweet sub-acid group listed above, to give tart flavor. Other varieties, not widely grown in the Maryland section, but good for cider are: Arkansas Black, Lawver, Missouri Pippin, Rhode Island Greening, Twenty Ounce and Yellow Bellflower.

Group 3—*Aromatic*—Delicious, Golden Delicious, Winter Banana, Roxbury, McIntosh and Bonum. Juices not so well balanced in sugar and acid content, but highly desirable for adding to the other juices (Group 2) as a blend, to add aroma and flavor. About 5 to 10% of such juice is added to the other juice.

Group 4—*Astringent*—Crab apples are used by some growers in making cider blends, adding about 3 to 5% of such juice to mixtures of Groups 1 or 2 to give a tang to the cider.

Group 5—*Neutral*—Ben Davis, Gano, Willowtwig, Missouri Pippin, Alexander and Wolf River. Poor quality for cider. May be used for bulk, but should be balanced by adding juice of aromatic (Group 3) and mildly acid (Group 2) varieties to give flavor.

Very few Maryland growers make a specialty of cider production. The blending of juices of various varieties gives good cider flavor. Where such actual mixing of juices is impossible, much the same effect is obtained by mixing the varieties as they are ground and pressed.

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Published Monthly by the Maryland State Horticultural Society

Edited by the Secretary, A. F. Vierheller, Extension Horticulturist

Vol. 5 **October, 1935** **No. 10**

*SOME RECENT RESULTS OF APPLE STORAGE INVESTIGATIONS**

H. H. PLAGGE, Iowa State College, Ames, Iowa.

The problems of apple storage are manifold, and for the most part become easier to understand as we learn more and more about the fundamental life processes of the fruit itself. The apple, like most other horticultural products which are kept in storage, is a living plant in part and possesses certain living processes which function much the same as in a growing plant. The apple is principally a storage organ, and contains besides much water large quantities of stored food, including starch, sugars, pectins and acids, as well as smaller proportions of cellulose materials and minerals. After it is picked, it no longer continues to store food but begins to utilize what food materials it then possesses. Just how fast these stored products are utilized in the fruit and just how long the supply will last depends on the conditions of storage, and chiefly on storage temperature.

Studies on the resporatory activity in apples.

In plants as well as in animals it is possible to measure how fast storage materials are being used by determining the respiratory activity. In respiration a plant utilizes stored materials and oxygen, and then throws off carbon dioxide (CO_2) and water. In measuring the amount of carbon dioxide given off or respired, we have a measure of the respiration or oxidation process. In other words, we can tell how fast an apple or a potato or a strawberry or other plant product is using up its storage reserves.

Respiration studies have been made on apples and other fruits many times, but in some instances only for short periods and on rather small samples of fruit. In 1928 and 1929 Dr. Paul L. Harding, who is now with the United States Department of Agriculture, made respiration studies on Grimes Golden apples under storage temperatures of 30°, 36°, 50° and 60° F. The samples used consisted of approximately one-half bushel lots of selected fancy fruit, and duplicate determinations were made throughout the storage period.

He noted that the respiratory activity was highest in the fruit stored at 60° F. and that it was lower in fruit held at 36° than at 50° F. In addition, he found that there are four general stages or periods of respiratory activity in the apple. These are (1) a short period of accelerated ascent: (2) a short period of rapid descent; (3) a longer period of gradual descent; (4) a

*From Transactions of the Iowa State Hort. Society, 1934.

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period of slight ascent. The last stage may be designated as the period of senescence, in which the apple begins to break down in storage from such complications as mealy breakdown, apple scald, etc.

Of what practical significance are these respiration studies? Various lots of fruit were delayed at 50° F. for different weekly intervals and then stored at 32° F. until January 20. It was noted that the apples which were stored at 50° F. for two, three, four and five weeks became very susceptible to soggy breakdown, whereas fruit which was stored immediately at 32° and that which was stored temporarily for intervals of six, seven, eight, etc., up to twelve weeks at 50° F. was not susceptible to breakdown. We have previously noted that a high respiratory activity existed in the apples the first few weeks they were stored at 50° F. Storing apples while the respiration rate was rapid resulted in high percentages of soggy breakdown; storing them while in a low stage of respiratory activity did not result in breakdown. The experiment has been repeated many times with practically the same results. The results show that a delay of only two weeks at the moderate temperature of 50° F. may prove rather disastrous. Still more serious results might be expected when the temperature during the interval between picking and cold storing is higher than 50° F. Common storage fruit never develops soggy breakdown because it is not subject to low temperatures (30°-34° F.) while in a high stage of respiratory activity.

Storage temperatures for apples.

It may be of interest to know that we are now recommending a storage temperature of 35°-36° F. for all varieties of apples. Our previous recommendation has been 35°-36° F. for only those varieties which were susceptible to soggy breakdown; viz., Grimes, Wealthy, Golden Delicious, Northwestern Greening, Rome Beauty and Jonathan. This conclusion was reached when it was found that all varieties ripened better in storage, developed better flavor and color, and were in all respects more desirable than fruit which has been stored at 31° to 32° F.

In making these recommendations on storage temperature, it is assumed that the apples be sound, carefully handled and stored promptly after packing. *Carelessly handled fruit* and fruit effected with scab and skin injuries *will keep better at the usual lower temperature range* (31°-32° F.), since apple rots are better controlled at the lower temperature. The lower temperatures also tend to check the development of apple scald. However, regardless of the storage temperature, whether high or low, the use of oiled paper in amounts sufficient for protection against scald is always recommended. In another bulletin, which is now ready for publication, detailed recommendations are given on the storage temperature for apples. This publication describes and illustrates in detail various functional diseases of apples in storage, such as apple scald, breakdown, watercore, bitter-pit, brown-heart, etc.

In a publication by the United States Department of Agriculture,[1] it has been pointed out that apples soften much more rapidly at 60° to 70° F. than in cold storage. For example, Virginia grown Grimes Golden softened as much

in 11 days at 70° as in 60 days at 32°. After 10 days at 70°, Stayman Winesap were softer than at the end of 100 days at 32°. Winesap at the end of 10 days at 70° were as soft as at the end of 6 months' storage at 32° F. McIntosh softened as much in 7 days at 70° as in 70 days at 32° F. The extent of softening in 1 day at 70° is approximately the same in most varieties as in 10 days at 32° F. The results of these tests emphasize the importance of storing apples promptly after picking.

Effect of ripe apples on growth of seed sprouts and on the ripening of freshly picked apples.

In the 1932 report of the food investigation board for Great Britain there is an interesting account of some respiration experiments with apples.[2] A few years ago Dr. O. H. Elmer of the Kansas Agricultural Experiment Station published an article in the Science Journal, in which he reported that ripe apples held in the same storage room with potatoes prevented them from sprouting. The English investigators have been able to check this work, and find further that ripe apples throw off something which keeps many kinds of seeds from sprouting normally. For example, when germinating pea seeds were enclosed with a ripe apple, the sprout growth was short, thick and stubby. When the apple was removed the new growth resumed its normal appearance. Similar results were obtained with many kinds of seeds.

The interesting result to fruit growers, however, was the effect of this "apple air" on other apples. Apples were placed in respiration jars, and it was found that if the air which was supplied to newly picked fruit was first passed through other jars containing old or fully ripe apples, the new apples respired more rapidly than if fresh air was supplied. In other words, there was something given off by the old apples which hurried the ripening of the freshly picked fruit. The English investigators point out that their experimental results may have practical significance, since ripe apples in a storage room may influence the keeping quality of less mature fruit, and state that their results suggest that the substance which ripe apples emanate and which causes these changes is probably ethylene. Perhaps a storage room partly filled with early maturing ripe apples is not a good place to store other winter varieties.

The use of carbon dioxide in the storing of fruits.

Another new development in the storage of fruits is the use of carbon dioxide in storage rooms. The principle upon which this method of storage is based is the inhibiting effect of the carbon dioxide on the ripening of fruits and on the growth of molds. Carbon dioxide in moderate concentrations is not harmful to the fruit, and it slows down respiration and ripening. Drs. Kidd and West of the Low Temperature Research Station in England have carried on gas storage investigations with fruit for many years. The method used in England consists of storing fruit in air-tight rooms, and allowing

just enough ventilation to keep the percentage of carbon dioxide at the correct figure. The fruit itself supplies the necessary carbon dioxide. Of course, the difficulty is to maintain the correct concentration. Good results have been obtained in an experimental way, and some commercial plants in England have used this method. Under gas storage, fruit can be stored at a higher temperature than is usually employed. Concentrations approximating 8 to 10 per cent of carbon dioxide are used for fruits.

In this country the efficacy of the application of carbon dioxide for the storage of fruits and vegetables is being determined by Dr. Charles Brooks and his associates of the United States Department of Agriculture.[3] Considerable progress has been made on this subject. However, it has been pointed out that the gas storage method cannot yet be recommended for general use because of the danger of injuring the fruit. The experiments were carried out in refrigerated boxes and cars at various temperatures and under different percentages of carbon dioxide. In the cars, the source of carbon dioxide was from blocks of solid carbon dioxide or dry ice. A few of the conclusions of these experiments may be of interest.

Carbon dioxide was more efficient in checking the softening of the fruit than in preventing the development of rots. Bartlett pears, Grimes Golden, Jonathan and Delicious apples were kept as firm and as free from disease by the initial carbon dioxide treatment as by immediate storage at 32° F. Carbon dioxide treatments were of value in preventing the shattering of grapes. The best results were obtained with grapes, peas, sweet corn and carrots; the poorest results with peaches, apricots, strawberries and red raspberries. Plums, cherries, blackberries, blueberries, black raspberries, currants, pears, apples and oranges exhibited a fair degree of tolerance to the carbon dioxide treatment.

Ripening temperatures for Kieffer pears.

Those of you who grow Kieffer pears may be interested in some experimental results obtained by Lutz, Culpepper and Moon.[4] These investigators stored Kieffer pears at temperatures of 32°, 40°, 50°, 60°, 65°, 70°, 80°, 90° and 100° F. and found that the most rapid softening occurred at 65°, followed closely by 60° F. The rate of softening decreased as the temperature was increased or lowered from 65° F., and when the pears were ripened at 60° both texture and flavor were considerably better than is usually obtained with this fruit. The flavor was better in fruit at 60° and 65° F. than at higher or lower temperatures.

[1] Magness, J. R., Diehl, H. C., Haller, M. H., et al. The ripening, storage and handling of apples. U. S. Dept. Agr., Dept. Bul. 1406. 1926.

[2] Kidd, F. and West, C. Effects of ethylene and of apple vapours on the ripening of fruits. Dept. Sci. and Ind. Res. Fd. Invest. Bd. Rpt. 1932. Section B. pp. 55-58.

[3] Brooks, Charles, Miller, E. V., et al. Effect of solid and gaseous carbon dioxide upon transit diseases of certain fruits and vegetables. U. S. Dept. Agr., Tech. Bul. 318. 1932.

[4] Lutz, J. M., Culpepper, C. W. and Moon, H. H. The relationship of ripening temperatures to the rate of softening texture and flavor of Kieffer pears. Proc. Amer. Soc. Hort. Sci., 30:229-232. 1933.

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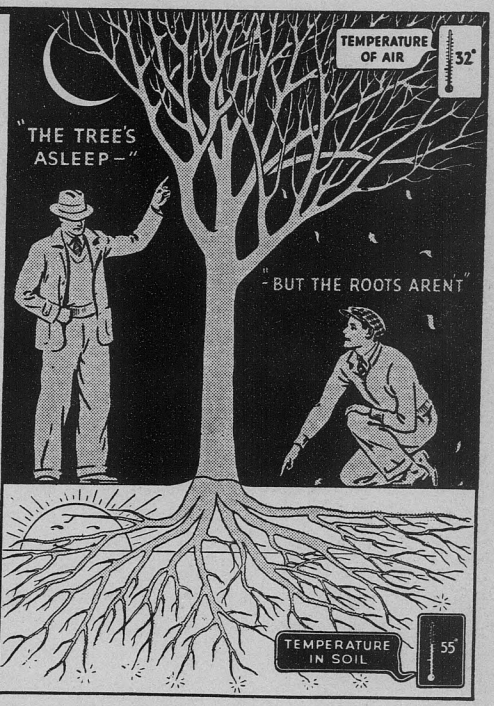

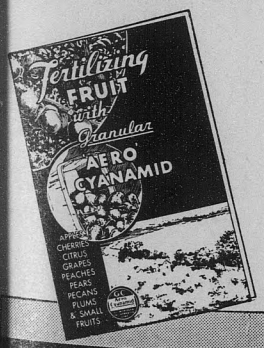

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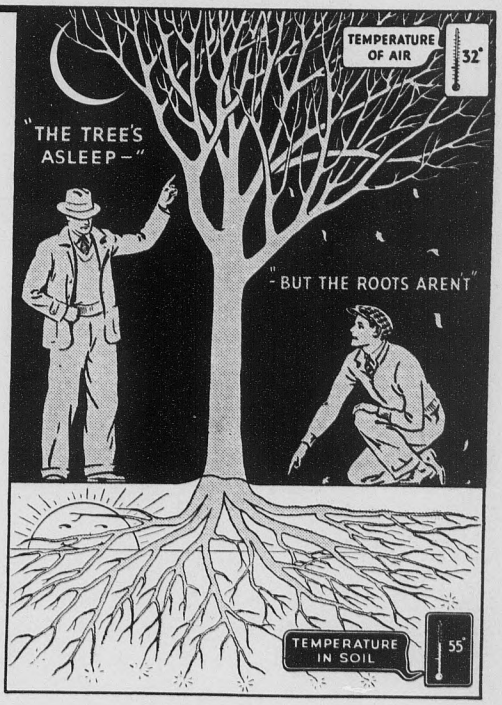

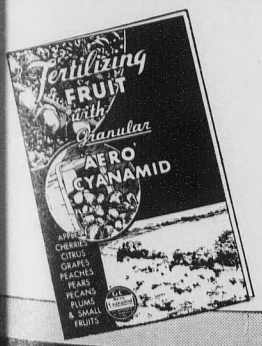

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